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# A Global Vision



**Exploration is critical to  
prosperity and human progress.**

# The Value of Human Spaceflight



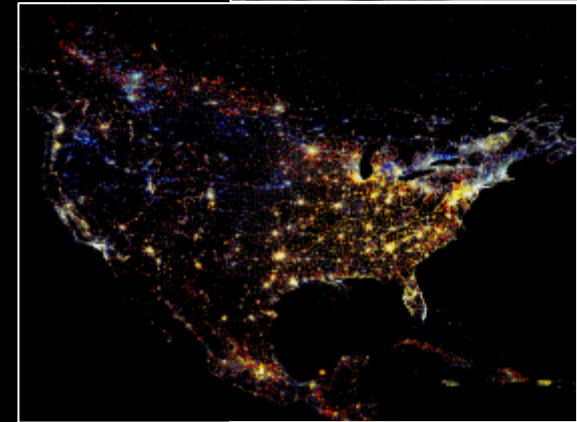
## Knowledge

Human space exploration inspires us to seek knowledge – through scientific discovery we increase our understanding of the world and how to make it better.



## Economic Growth

Human space exploration directly contributes to the economy – fueling the creation of new industries, job growth and the demand for a highly skilled workforce.



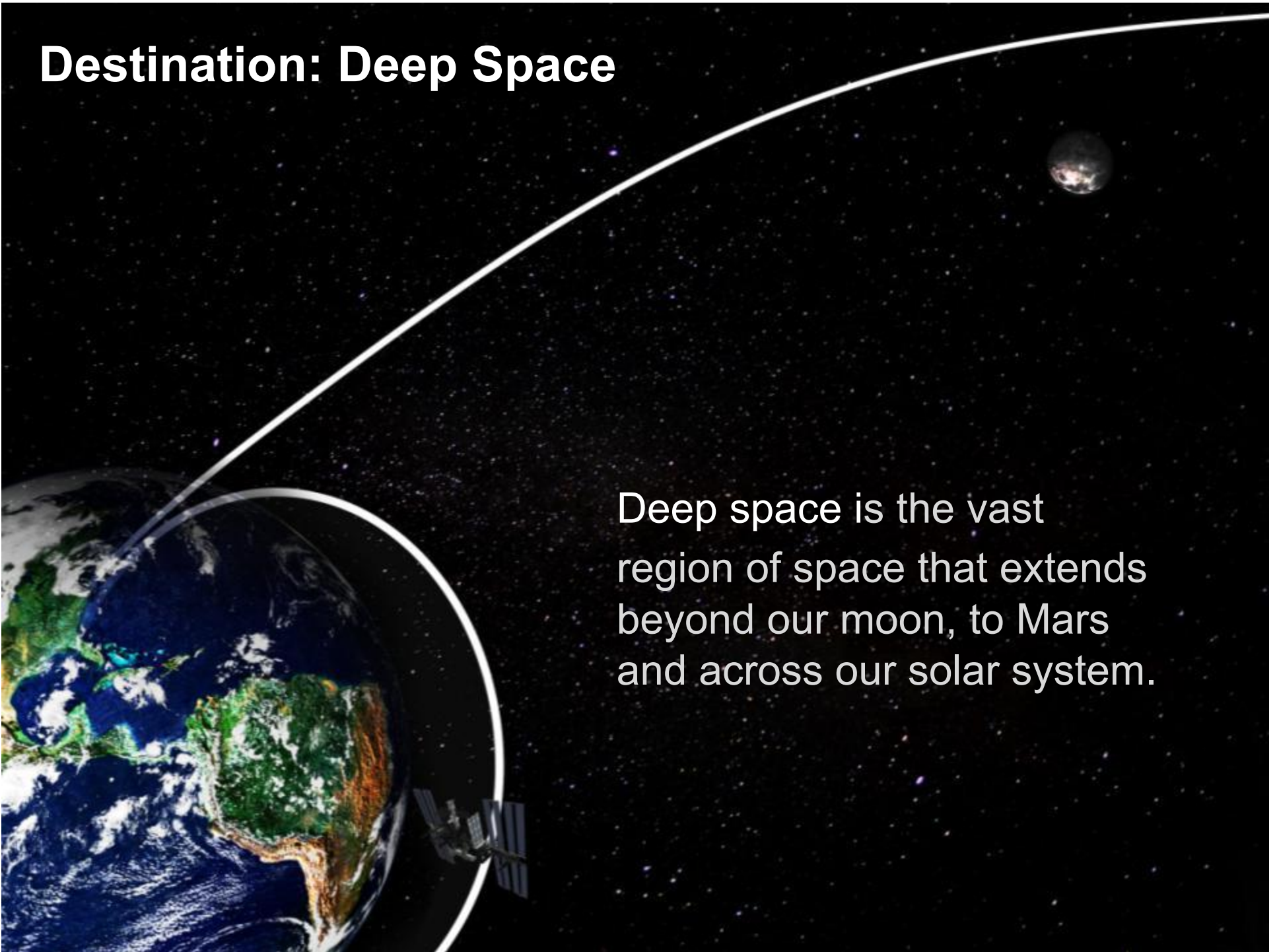
## A Better Life

Human space exploration is a catalyst for a better life – advancing American leadership and creating a path for peace, diplomacy and global cooperation.



# Destination: Deep Space

Deep space is the vast region of space that extends beyond our moon, to Mars and across our solar system.







**EARTH  
RELIANT**

**PROVING  
GROUND**

**EARTH  
INDEPENDENT**

# Principles for Incrementally Building Capabilities



Six key strategic principles to provide a sustainable program:

1. Executable with current *budget with modest increases*
2. Application of *high Technology Readiness Level* (TRL) technologies for near term, while focusing research on technologies to address challenges of future missions
3. *Near-term mission* opportunities with a defined cadence of compelling missions providing for an incremental buildup of capabilities for more complex missions over time
4. Opportunities for *US Commercial Business* to further enhance the experience and business base learned from the ISS logistics and crew market
5. *Multi-use* Space Infrastructure
6. Significant *International participation*, leveraging current International Space Station partnerships

# ISS Enables Long Duration Exploration



- Health and Human Performance
- Crew Habitability and Logistics
- Technology Testbed
  - Docking System
  - High Reliability Closed Loop Life Support
  - Long Term System Performance
  - Logistics and Maintenance Reduction
- Commercial Cargo and Crew Transportation Services to LEO
- Commercial Application of Microgravity and Space Research for Terrestrial Application





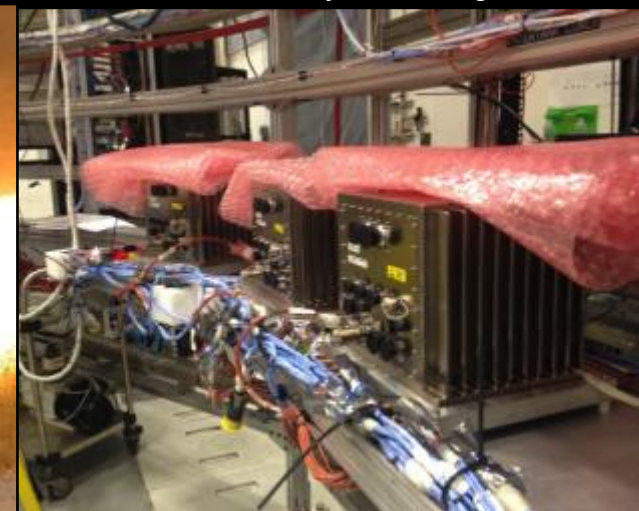
# America's New Rocket: Space Launch System



Three Successful Ground Tests of Booster Developmental Motors



Core Stage Flight Computers Installed and almost ready for testing



SLS is the rocket and launch system capable of transporting humans, habitats and support systems directly to deep space.  
Powerful – High-Capacity – Flexible – Manufacturable



Barrel Section Complete at MAF



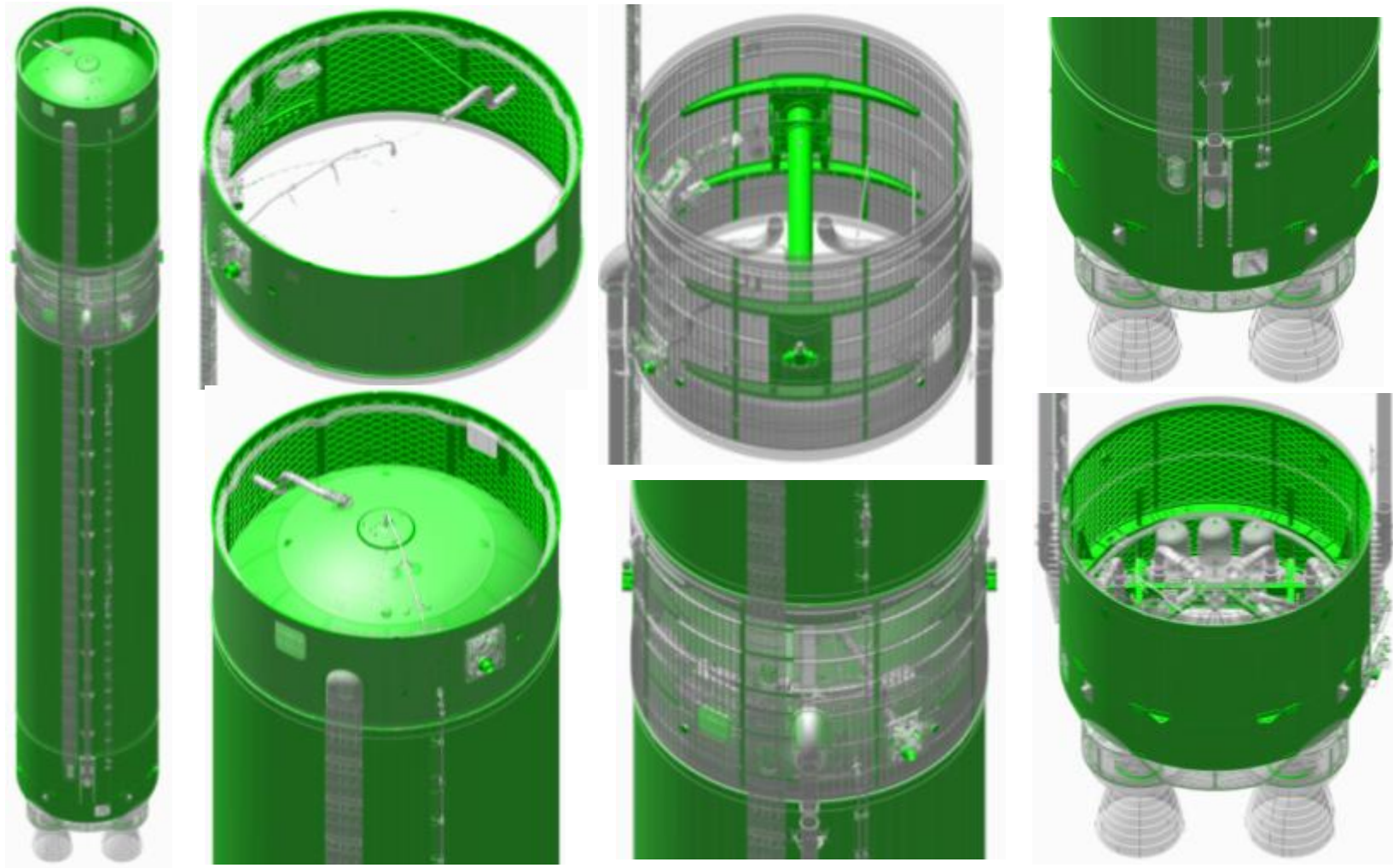
RS-25 Test Firing



Barrel Weld Center



# Core Stage Drawing Release – 70% Complete



Updated: 10/17/2013





# America's New Crew Capsule: Orion



Orion Propulsion and Life Support System  
Assembly



Parachute Drop Tests



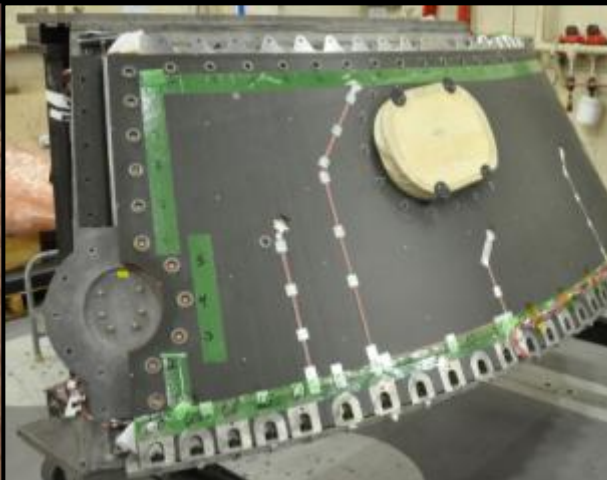
Orion Post Landing Recovery Test



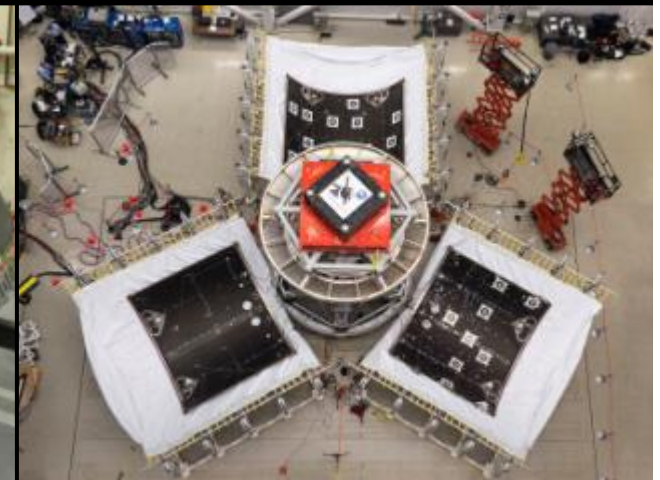
Orion is the first spacecraft in history  
capable of taking humans to multiple destinations in deep space.  
Long Duration – Adaptable – Life Sustaining



Heat Shield Developmental Flight  
Instrumentation Complete



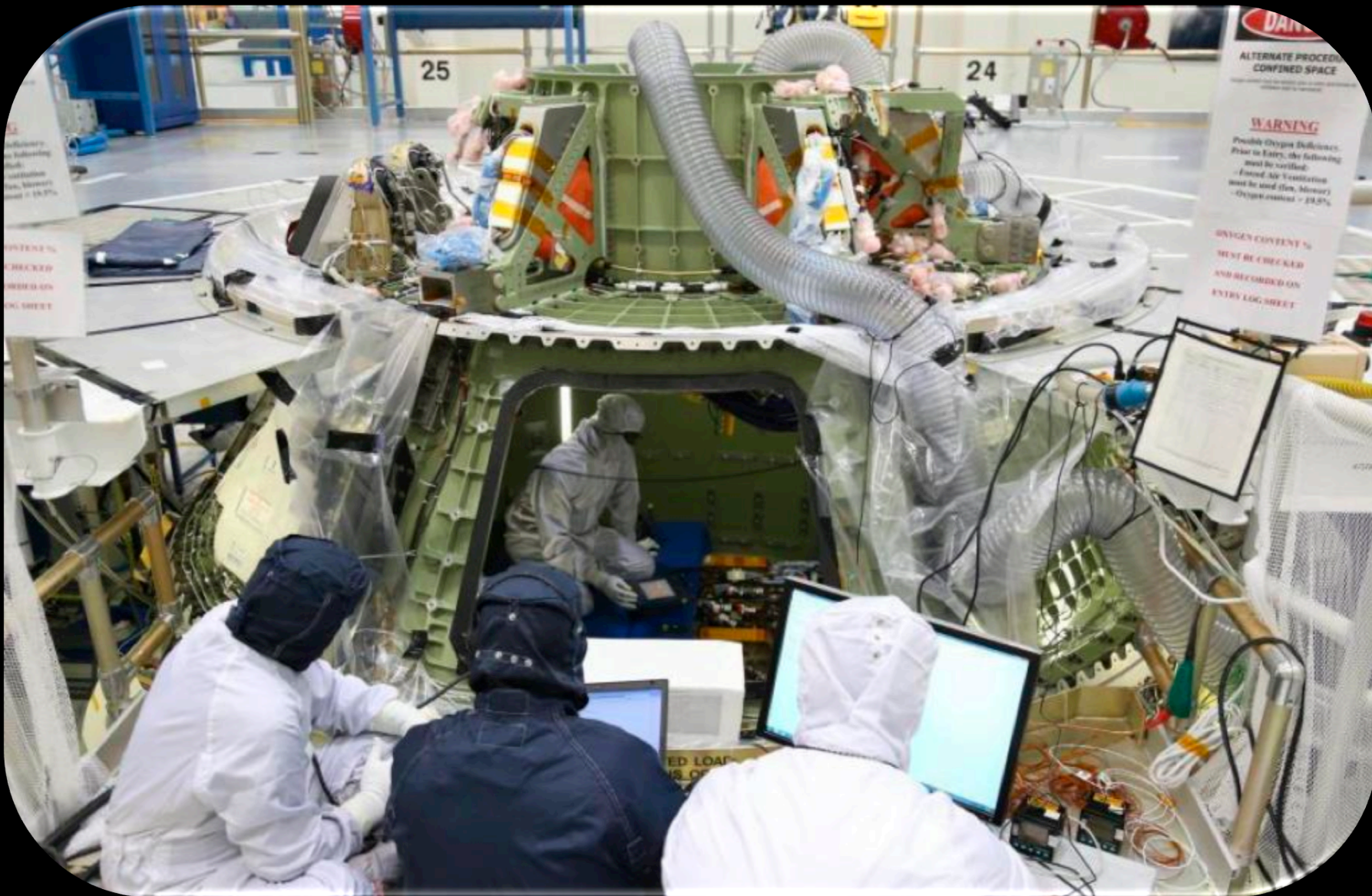
Thermal Protection System Thermal  
and Backshell



Successful Fairing Separation Test



# Orion Fully Powered at KSC



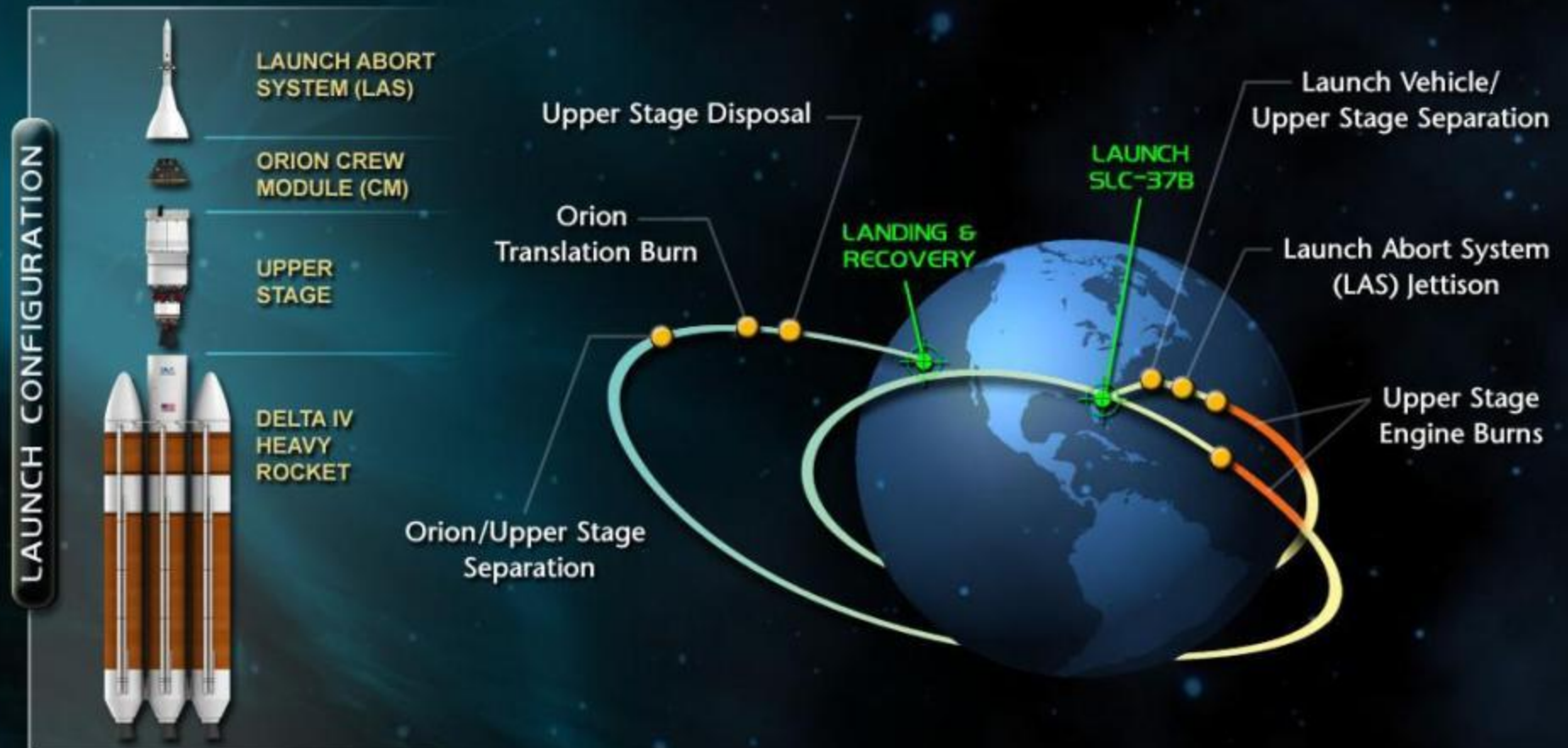
2014



# EXPLORATION FLIGHT TEST ONE

OVERVIEW

TWO ORBITS • 20,000 MPH ENTRY • 3,671 MILE APOGEE • 28.6 DEGREE INCLINATION





# Building to Exploration Flight Test-1



FY12

FY13

FY14

ACCOMPLISHMENTS

June 2012

Crew module to KSC



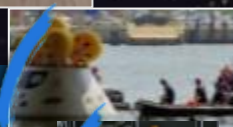
February 2013 Heat shield structure completed



October 2011 - July 2013 Nine successful parachute tests



August 2013 Stationary recovery test at Norfolk



September 2013 Avcoat application completed; testing begins



October 2013 Orion power-on at KSC



November 2013 Successful fairing separation test



WHAT'S NEXT

November 2013 Heat shield shipment to KSC

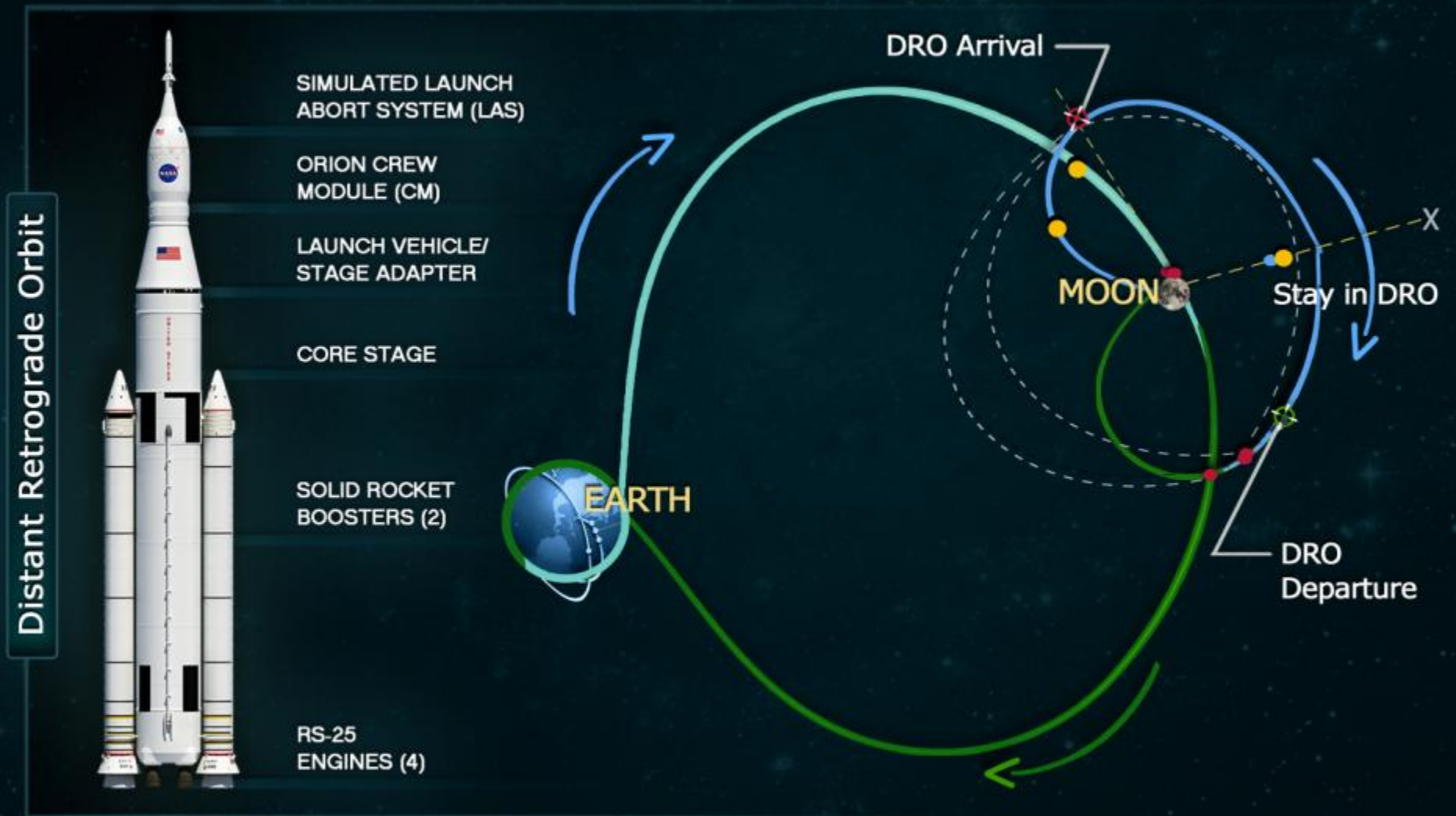
December 2013 Crew module / service module mate

March 2014 Flight test article ready

Fall 2014 **EXPLORATION FLIGHT TEST (EFT-1)**



# Exploration Mission One (EM-1)





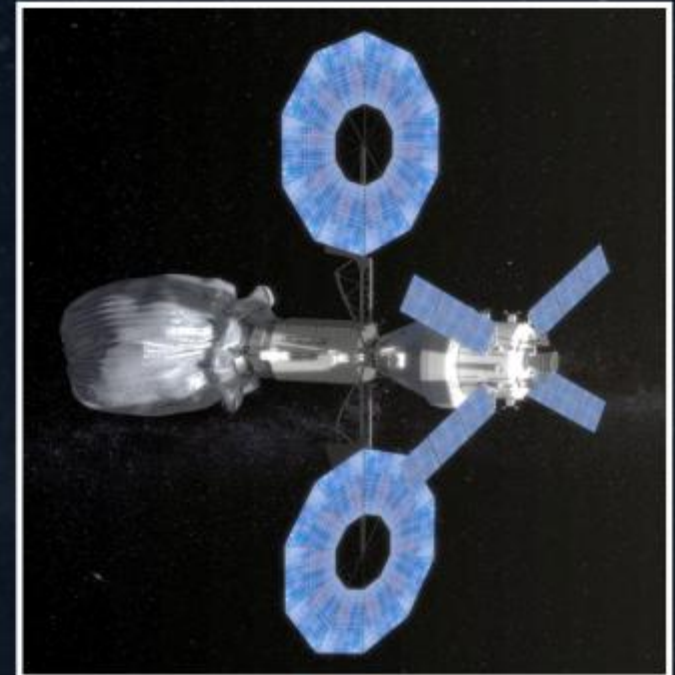
# Asteroid Redirect Crewed Mission Overview



Deliver crew  
on SLS/Orion



Attached Orion to robotic spacecraft



Perform extra-vehicular activity (EVA) to retrieve asteroid samples



Return crew safely to Earth with asteroid samples in the Orion



**The Asteroid Redirect Mission with the crewed missions is a critical first step to reducing risk and advancing the core capabilities and mission operations required for human exploration of Mars.**

- **System Capabilities**

- Orion crew vehicle and SLS launch vehicle performance validation
- Solar electric propulsion for pre-deployment of logistics
- Potential addition of an exploration augmentation module
  - Provide long duration system testing
  - Deep space environmental testing
  - Integration of vehicle systems
- Potential use of In-Situ Resources (allow commercial entities to experiment with asteroid materials)
- Rendezvous and Docking with both cooperative and uncooperative objects

- **Deep Space Operational Capabilities**

- Autonomous operations to mitigate moderate communication time delays
- Deep space navigation
- Potential high band-width deep space communications ( follow on to lunar communication)
- Dynamics of prepositioning and moving / large objects in space
- Surface system interactions and mobility with near zero-g solar system objects (EVA suit and tools, surface operations) – extensible to Mars moons exploration
- Sample collection and curation (science, analog to Mars planetary protection operations)

- **Incremental retirement of critical operational Strategic Knowledge Gaps**

# Partners and Suppliers in America







A DEEPER VISION, **A BOLDER MISSION**, ONE STEP AT A TIME

Step One:  
**2014**